

PROCEEDINGS

OF THE

GENERAL MEETINGS FOR SCIENTIFIC BUSINESS

OF THE

ZOOLOGICAL SOCIETY OF LONDON.

1901, Vol. I. (January to April).

January 15, 1901.

Prof. G. B. HOWES, LL.D., F.R.S., Vice-President,
in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of December 1900 :—

The registered additions to the Society's Menagerie during the month of December 1900 were 211 in number. Of these 91 were acquired by presentation and 16 by purchase, and 104 were received on deposit. The total number of departures during the same period, by death and removals, was 158.

Amongst the additions attention may be specially directed to the seven specimens of Verreaux's Guinea-fowl (*Guttera edouardi*) presented on December 31st by Mr. J. E. Walker of Bulawayo. Mr. Walker states that this Guinea-fowl is found only, so far as he knows, in the Wankie Hills, a district due north of Bulawayo, and about midway between that city and the Zambesi. Only one specimen of it had previously reached the Society's aviaries (see P. Z. S. 1890, p. 86).

I wish also to direct attention to the valuable series of Indian birds lately presented to the Society by Mr. E. W. Harper, F.Z.S., of Calcutta, consisting of examples of twenty species, all new to the Society's Collection, of which the following is a list.

First consignment (August 14th, 1900):—

- 1 Indian Roller (*Coracias indica*).
- 1 Bengal Weaver-bird (*Ploceus bengalensis*) ♂.
- 1 Manyar Weaver-bird (*Ploceus manyar*) ♂.
- 4 Black-throated Weaver-birds (*Ploceus atrigula*), 2 ♂,
2 ♀.

Second consignment (September 21st, 1900):—

- 2 Western Yellow-winged Laughing-Thrushes (*Trochalo-*
pterum nigrimentum) ♂ ♀.
- 1 Rufous-chinned Laughing-Thrush (*Ianthocincla rufi-*
gularis).
- 1 Slaty-headed Scimitar Babbler (*Pomatorhinus schis-*
ticeps).
- 1 Black-throated Ouzel (*Turdus atrigularis*) ♂.
- 2 Tickell's Ouzels (*Turdus unicolor*).
- 1 Spotted-wing (*Psaroglossa spiloptera*).

Third consignment (November 27th, 1900):—

- 4 Ashy-crowned Finch-Larks (*Pyrhhalanda grisea*), 3 ♂,
1 ♀.
- 2 Singing Bush-Larks (*Mirafra cantillans*) ♂ ♀.
- 2 Slaty-headed Parrakeets (*Palaeornis schisticeps*) ♂ ♀.
- 1 Burmese Slaty-headed Parrakeet (*Palaeornis finschi*) ♂.
- 1 Golden-eyed Fruit-Pigeon (*Carpophaga concinna*).

Fourth consignment (January 1st, 1901).

- 2 Blue-winged Sivas (*Siva cyanoptera*).
- 1 Silver-eared Mesia (*Mesia argentauris*).
- 1 White-capped Redstart (*Ruticilla leucocephala*).
- 1 Rufous-bellied Niltava (*Niltava sundara*).
- 1 Burmese Roller (*Coracias affinis*).

Mr. W. E. de Winton exhibited a specimen of the large Grey Meerkat (*Cynictis selousi* de Winton), described in the 'Annals and Magazine of Natural History,' ser. 6, vol. xviii. 1896, p. 469, hitherto known from a skull only, obtained near Bulawayo.

The skin exhibited (see Plate I.) together with a skull, had been obtained by Mr. P. C. Reid on the west bank of the Linyanti River on the 5th July, 1899. The following description was given:—

Size about half as large again as the Bay Meerkat (*C. penicillata*); body-colour grizzled drab-grey; hairs of the tail broadly white-tipped; both fore and hind feet black; belly buff. The grizzling of the head and body is much coarser than in the Bay Meerkat, owing to the broader annulations on the hair, but the pattern on the hairs of the tail is similar in both species. There is an entire absence of rufous in the colouring of the Grey Meerkat, the tips of the under-fur and the broad subbasal band of the



J Smit del. et lith.

CYNICTIS SELOUSI.

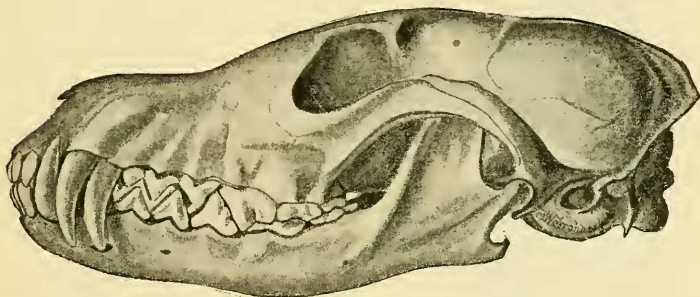
Mintern. Broc. imp.

coarser fur being dull buff, and the tail whitish instead of orange colour. The hands and feet of the larger species are black, while in the smaller they are golden-fawn.

Measurements taken from the dried skin:—Head and body 400 millim., tail 230, hind foot 90, ear 30: all these figures must be considered only approximate.

Mr. Lydekker exhibited the skull of an English Fox (*Canis vulpes*) with two perfect canine teeth on each side of the upper jaw (see text-fig. 1). A dog's skull with the upper canine of each side partially divided had been figured on p. 211 of Mr. Bateson's

Text-fig. 1.



Skull of Fox showing double canine teeth.

Study of Variation, and the present specimen would seem to indicate a fuller development of the same feature. An instance of the full duplication of the corresponding teeth of both sides was afforded by the skull of a Cat figured on p. 225 of the work cited.

The Fox to which the skull belonged had been killed by the South Oxfordshire Hounds. The skull itself was the property of Mr. H. G. Pease.

In describing the collection of Fishes brought home from Lakes Tanganyika and Kivu by the Tanganyika Exploring Expedition, under the leadership of Mr. J. E. S. Moore, Mr. G. A. Boulenger pointed out that the study of this important collection did not modify the conclusions embodied in his first report published in 1898. The exploration of Lake Kivu had thrown no light on the origin of the Tanganyikan fauna; the smaller lake had proved to be very thinly populated with Fishes, which all belonged to widely distributed genera, the species showing a mixture of Nile and Tanganyika elements, with two that might prove to be endemic. The list of the Fishes from the two lakes comprised 91 species, 74 of which had been named by the author. The collection now described consisted of examples of 50 species, 26 of which were

new to science, two being made the types of additional genera of the family *Cichlidae*.

This Memoir will be published in full in the Society's 'Transactions.'

The following papers were read:—

1. On the Fishes collected by Dr. W. J. Ansorge in the Niger Delta. By G. A. BOULENGER, F.R.S., F.Z.S.

[Received January 4, 1901.]

(Plates II.-IV.¹)

Whilst recently staying at Sapelle Station, at the junction of the Ethiop and Jamieson Rivers, Dr. Ansorge has, at my request, made a small collection of the Fishes, which proves to be of quite an exceptional interest, from the fact that through it representatives of two families are added to the African freshwater fish-fauna, one being even entirely new, an event that has not happened since 1873, when the late Professor Peters described the genus *Pantodon*, the type of the family *Pantodontidae*. I feel extremely grateful to Dr. Ansorge for the trouble he has taken, under difficult circumstances and without better preserving-fluid than common trade-gin.

The collection was made in August and September 1900. Some of the small Perch-like fishes (*Cichlidae*) were caught with hook and line baited with worms. But most of the fishes, including *Calamichthys*, the Mormyrs, and the new *Phractolemus*, were captured in creels baited with the orange-red fleshy nut of the oil-palm, set at the mouth of the Ethiop River, close to the bank, by Dr. Ansorge's native boy. All these fishes are considered good-eating by the blacks.

I am pleased to add that the examples of the new species have been generously presented to the British Museum by Dr. Ansorge.

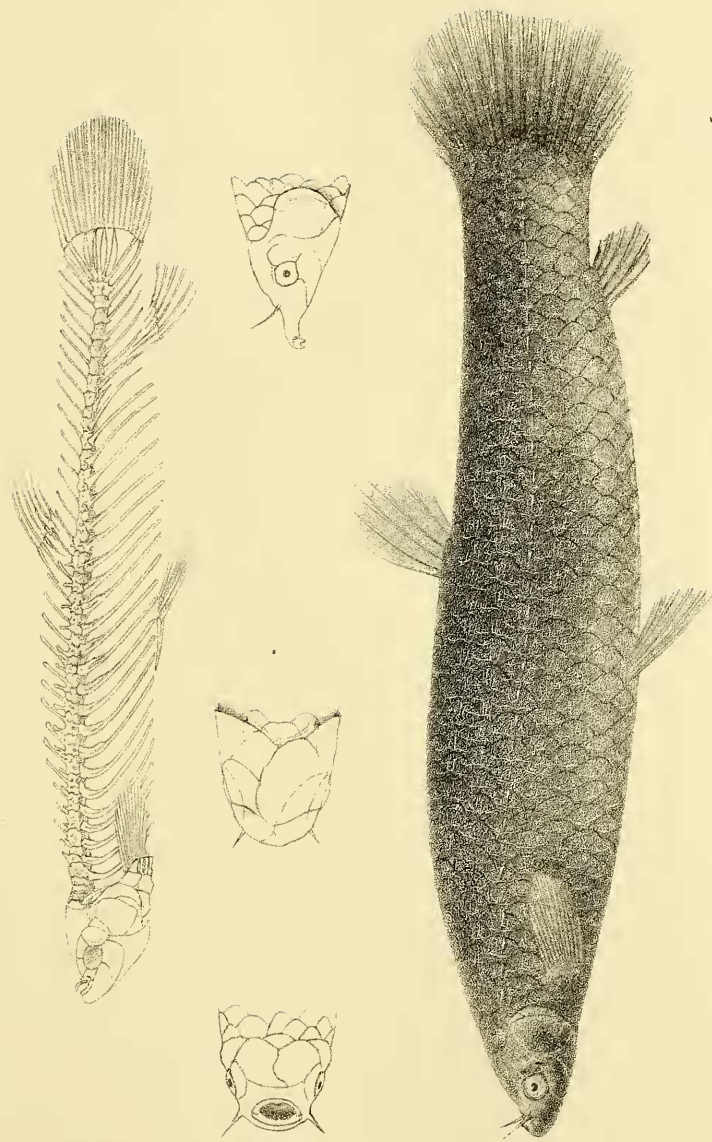
POLYPTERIDÆ.

1. CALAMICHTHYS CALABARICUS J. A. Smith.

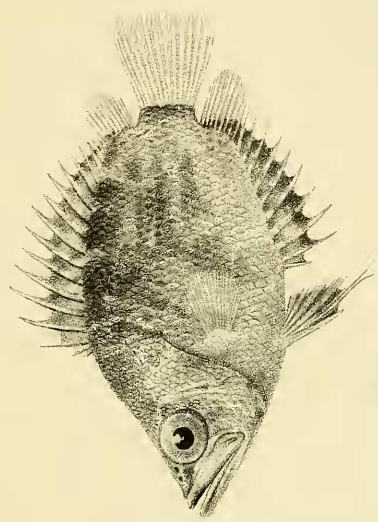
The single specimen contained in the collection, a female measuring 345 millimetres, with 11 dorsal spines, is extremely remarkable for having a very small, but perfectly distinct suboperculum. The absence of this bone, verified on a considerable number of specimens, had been regarded as one of the generic characters distinguishing *Calamichthys* from *Polypterus*. The coloration of the specimen is a dark olive-brown above, gradually shading into a bright yellow beneath; a large deep-black spot on the pectoral fin.

Every possibility of the presence of a suboperculum indicating a

¹ For an explanation of the Plates, see p. 10.



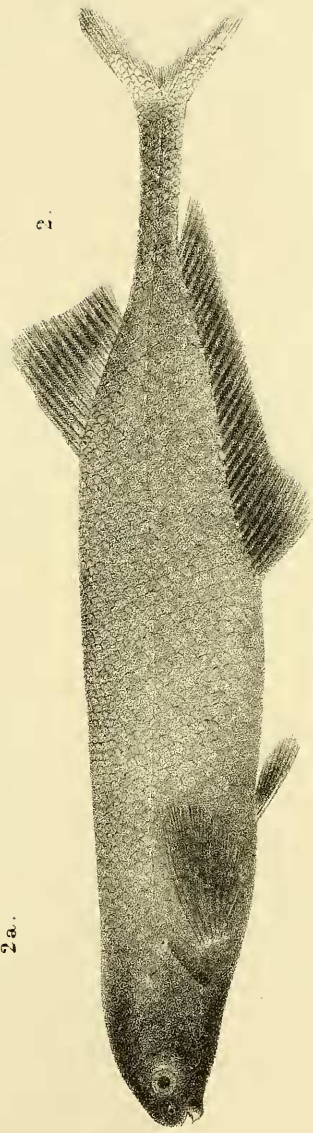




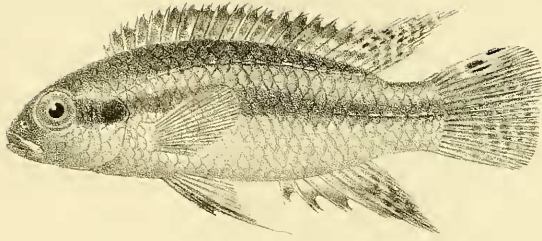
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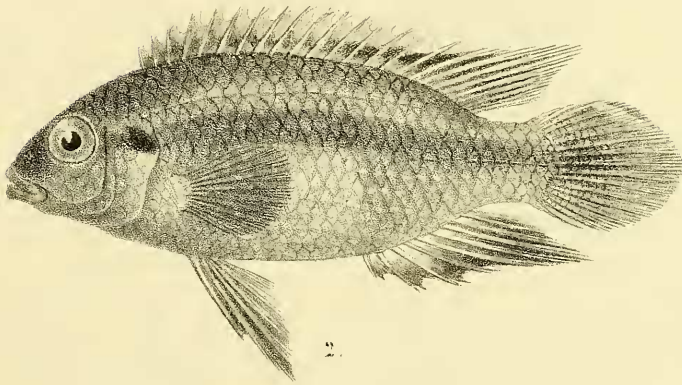
2 a.



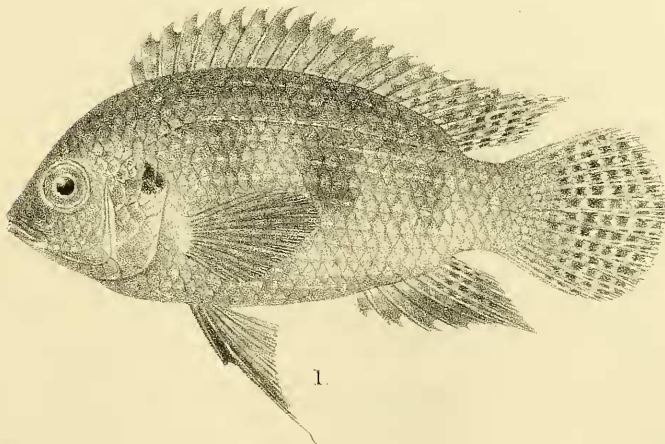
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3.



2.



1.

P. J. Smit del et lith.

1. PELMATOCHROMIS ANSORGHII.

2. P. PULCHER.

Mitern Bros. imp.
3. P. TÆNIATUS.

species distinct from *Calamichthys* seems to me removed by the fact that I have carefully compared this specimen with others likewise from the Niger delta, without being able to detect any other important difference. I look upon it as an atavistic individual anomaly.

MORMYRIDÆ.

2. *ISICHTHYS HENRYI* Gill.

The single specimen is more elongate than any on record, the depth of the body being contained 13 times in the total length, the length of the head $8\frac{1}{4}$ times. D. 53; A. 52; lat. l. 140. Total length 210 millim.

3. *MARCUSENIUS LONGIANALIS*, sp. n. (Plate III. fig. 1.)

Depth of body 5 to $5\frac{2}{3}$ times in total length, length of head 6 to $6\frac{1}{2}$ times. Head $1\frac{1}{4}$ as long as deep; snout convex, $\frac{1}{4}$ length of head, slightly projecting beyond the mouth; latter small, sub-inferior, below level of eye, its width $\frac{1}{6}$ length of head; teeth feebly notched, 5 in the upper jaw, 6 in the lower; nostrils nearly equally distant from end of snout and from eye, anterior on a level with centre of latter, posterior with its lower border; eye small, $\frac{1}{2}$ length of snout, $\frac{2}{5}$ interorbital width. Dorsal 15-16, its length $\frac{1}{4}$ its distance from the head, originating above 16th or 17th ray of anal. Anal 32-33, thrice as long as dorsal, nearer base of caudal than base of ventral. Pectoral obtusely pointed, a little shorter than head, $1\frac{2}{3}$ length of ventral, reaching base of latter. Caudal scaly at the base, with pointed lobes. Caudal peduncle $3\frac{1}{2}$ times as long as deep, nearly as long as head. 63 to 66 scales in the lateral line, $\frac{9}{10}$ in a transverse line on the body, $\frac{6-7}{6-7}$ between dorsal and anal, 12 round caudal peduncle. Purplish brown, more or less profusely speckled with blackish; fins dark brown.

Total length 145 millim.

Two specimens.

Closely allied to *M. brachyhistius* Gill. Distinguished by the more elongate form, the more slender caudal peduncle, the longer anal fin, and the higher number of scales in the lateral line.

NOTOPTERIDÆ.

4. *NOTOPTERUS AFER* Gthr.

PHRACTOLEMIDÆ.

The highly remarkable fish discovered by Dr. Ansorge, which I here describe under the name of *Phractolemus ansorgii*, cannot be incorporated into any of the families known at present. It falls into the suborder Malacopterygii as restricted and defined by me¹, and occupies a position intermediate between the *Osteoglosside* and the *Clupeide*. The family *Phractolemidæ* may be characterized as follows:—

Mouth edentulous, projectile, bordered by the very slender

¹ Poissons du Bassin du Congo, p. 44 (1901).

premaxillaries and maxillaries. Supraoccipital in contact with the frontals, widely separating the small parietals. Operculum and suboperculum well developed; preoperculum small; interoperculum enormous, covering the gular region and overlapping its fellow; symplectic absent; only three slender branchiostegal rays; no pharyngeal teeth. Ribs stout, sessile, nearly completely encircling the body; slender epineurals; no epipleurals; caudal region very short. No postclavicle. Pectoral fins inserted low down, folding like the ventrals; latter with 6 rays.

PHRACTOLEMUS, gen. n.

Body elongate, subcylindrical, covered with large striated scales; lateral line complete, formed of a series of straight tubes extending along the entire length of the exposed part of the scales. Head small, strongly ossified, covered with thin skin; mouth small, proboscisiform, capable of being thrust forward, when at rest folded over and received into a depression on the upper surface of the head; a single narial orifice, preceded by a barbel; eyes small, lateral. Gill-openings narrow, restricted to the sides; gular region protected by the interopercles, that on one side (usually the right) overlapping that on the other side. Four gills; no pseudobranchiæ. Pectoral fins small, with 18 rays; ventrals far back, with 6 rays; dorsal short, with 6 rays, opposite to the space between the ventrals and the anal; latter short, with 6 rays; caudal fan-shaped, with 18 to 20 rays; all the fin-rays articulated. Air-bladder very large, extending as far back as the anal fin. Stomach with 3 pyloric appendages; intestine extremely long and much convoluted.

5. PHRACTOLEMUS ANSORGII, sp. n. (Plate II.)

Depth of body 5 to 6 times in total length, length of head $6\frac{1}{2}$ to $7\frac{2}{5}$ times. Head depressed, with very broad, slightly convex interorbital region; diameter of eye $4\frac{1}{2}$ to $5\frac{1}{2}$ times in length of head, 3 to $3\frac{1}{2}$ times in interorbital width; barbel nearly $\frac{1}{3}$ length of head. Dorsal with the two anterior rays simple, the other four bifid; the first ray equally distant from the head and from the root of the caudal; second ray longest, $1\frac{1}{2}$ length of head. Anal similar to dorsal, but rays shorter, the second or longest only $\frac{3}{4}$ length of head. Pectoral rounded, a little shorter than head, as long as ventral, which is pointed and equally distant from head and from anal. Caudal rounded. Caudal peduncle compressed, nearly as long as deep, as long as head. Scales large, longitudinally striated, 35 to 37 in a longitudinal series, $\frac{33}{4}$ in a transverse series. On the caudal region the scales of the lateral line and those of the series above it may bear a central sclerous tubercle (probably a seasonal character). Uniform olive-grey.

The vertebræ, in a male specimen of which a skeleton has been prepared, number 34, 26 precaudal and 8 caudal, the last bearing 6 hypurals to support the homocercal fin; the ribs are subequal,

very thick, with a wing-like expansion behind at the base, and begin on the second vertebra, there being besides a strong occipital rib. The frontals are very large and the right extends with its curved border beyond the median line, as if overlapping its fellow: two supraorbital bones on each side; the parietals are very small, and completely separated by the broad and short supraoccipital, which does not bear a crest. The pair of large bones covering the throat, the right overlapping the left, and which at first suggest the gular plates of the *Polypteridæ*, are to be identified as interoperculum; above the interoperculum two very large suborbitals, covering the hyomandibular and quadrate, which are thrust forward for the suspension of the feeble mandibular rami, which are disconnected at the symphysis; the premaxillary and maxillary bones more slender still and connected by ligament with the mandible. The shoulder-girdle is suspended from the posttemporal close to the operculum; it includes the ordinary elements (clavicular, supraclavicular, coracoid, scapula), but a postclavicular is absent: the mesocoracoid arch is present, slender; the coracoids are much smaller than the claviculars, and do not meet on the median line: 4 pterygials support the pectoral fin-rays.

Four specimens of this extraordinary fish, measuring from 50 to 150 millim., were brought home by Dr. Ansonge, to whom it gives me great pleasure to dedicate the species.

CHARACINIDÆ.

6. *SARCODACES ODOË* Bl.
7. *ALESTES LONGIPINNIS* Gthr.

SILURIDÆ.

8. *CLARIAS ANGOLENSIS* Sldr.
9. *SCHILBE DISPILA* Gthr.
10. *CHRYSICHTHYS NIGRODIGITATUS* Lacép.
11. *MALOPTERURUS ELECTRICUS* Gm.

CYPRINODONTIDÆ.

12. *HAPLOCHILUS INFRAFASCIATUS* Gthr.

OPHIOCEPHALIDÆ.

13. *OPHIOCEPHALUS OBSCURUS* Gthr.

ANABANTIDÆ.

14. *ANABAS KINGSLEYÆ* Gthr.

NANDIDÆ.

The *Nandidæ* (including the *Polycentridæ*) are a small family of

freshwater fishes from S.E. Asia and South America, apparently most nearly allied to the *Centrarchideæ*, but distinguished from them by the absence of the entopterygoid.

The new genus here described is its first-known African representative.

POLYCENTROPSIS, gen. n.

Body short, elevated, very strongly compressed; scales moderately large, ciliated. Lateral line incomplete, reduced to a few tubes. Mouth large, extremely protractile, the ascending processes of the premaxillaries extremely long and extending to the occipital region; villiform bands of very small teeth in the jaws, on the vomer, and on the palatines; head for the greater part covered with scales; præorbital, præopercle, and interopercle serrated: opercle ending in a spine. Gill-membranes separate; six branchiostegals; no pseudobranchiæ. Dorsal and anal fins nearly equally developed, with numerous strong spines and the soft portion much reduced. Ventrals below the pectorals, close together, with a strong spine. Vertebrae 23 (10 + 13)¹.

15. POLYCENTROPSIS ABBREVIATA, sp. n. (Plate III. fig. 2.)

Depth of body twice in total length, length of head twice and a half. Snout acutely pointed, chin slightly projecting; diameter of eye a little longer than snout or interorbital width; nearly one third length of head; maxillary extending to below posterior third of eye; suborbital arch very slender; 6 or 7 series of scales on the cheek. 10 gill-rakers on lower part of anterior arch, the longest nearly as long as gill-filaments. Dorsal XV-XVI 11; spines increasing in length to the fourth and decreasing from the seventh or eighth, the longest half length of head and a little longer than the soft rays. Anal similar, X 9. Pectoral obtusely pointed, half length of head. Ventral longer, produced in a filament, extending beyond origin of anal. Caudal truncate. Caudal peduncle extremely short. Sq. 32-35 $\frac{4}{17}$; lat. l. 5-6. Pinkish brown, marbled with darker; spinous dorsal and anal dark brown, with darker and lighter spots and edged with black; ventrals blackish; base of soft dorsal, anal, and caudal blackish, edged with pink.

Total length 68 millim.

Two specimens.

CICHLIDÆ.

16. HEMICHROMIS FASCIATUS Peters.

17. HEMICHROMIS BIMACULATUS Gill.

18. PELMATOCHROMIS GUENTHERI SAUV.

(*Hemichromis voltae* Sldr.; *H. tersquamatus* Gthr.)

19. PELMATOCHROMIS ANSORGII, sp. n. (Plate IV. fig. 1.)

Teeth in 2 or 3 series in each jaw, outer largest but rather small. Depth of body $2\frac{1}{5}$ to $2\frac{1}{3}$ times in total length, length of

¹ *Nandus marmoratus* has also 23 vertebrae, but 13+10.

head $2\frac{1}{5}$ or 3 times. Snout broad, rounded, with straight or slightly convex upper profile, as long as the diameter of the eye, which is contained $3\frac{1}{2}$ to $3\frac{2}{3}$ times in length of head and $1\frac{1}{3}$ times in interorbital width; maxillary extending to below anterior border of eye; 3 or 4 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 10 or 11 on lower part of anterior arch. Dorsal XV-XVI 10-11; spines subequal, not quite $\frac{1}{2}$ length of head; middle soft rays somewhat produced, $\frac{3}{4}$ or $\frac{4}{5}$ length of head. Pectoral $\frac{2}{3}$ or $\frac{3}{4}$ length of head. Ventral produced into a filament, reaching origin of anal or a little beyond. Anal III 8; third spine as long as dorsals. Caudal rounded. Caudal peduncle much deeper than long. Scales smooth, with very distinct concentric striation, 28-29 $\frac{3}{10}$; lat. l. $\frac{17-19}{8}$. Dark olive-brown above, yellowish beneath; a blackish opercular spot; three or four vertically elongate large dark spots on each side of the body, below the upper lateral line; fins greyish, soft dorsal, anal, and caudal chequered with small darker and lighter spots.

Total length 90 millim.

Four specimens.

Allied to the preceding, from which it differs chiefly in the shorter snout, the smaller mouth, and the more rounded caudal.

20. PELMATOCHROMIS PULCHER, sp. n. (Plate IV. fig. 2.)

Teeth in 4 or 5 series in each jaw, outer largest. Depth of body $2\frac{2}{3}$ to 3 times in total length, length of head 3 to $3\frac{1}{2}$ times. Snout broad, rounded, with convex upper profile, as long as the eye, which is contained $3\frac{1}{3}$ times in length of head and does not quite equal interorbital width; maxillary extending to between nostril and eye; 2 or 3 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 10 to 12 on lower part of anterior arch. Dorsal XVI 9-10; spines gradually increasing in length to the last, which measures half length of head; some of the soft rays more or less produced, often longer than the head. Pectoral $\frac{2}{3}$ or $\frac{3}{4}$ length of head. Ventral more or less produced into a filament, reaching origin of anal, or beyond. Anal III 7-8; third spine as long as longest dorsal. Caudal rounded or subacuminate. Caudal peduncle as long as deep. Scales smooth, 27-29 $\frac{2-2\frac{1}{2}}{10}$; lat. l. $\frac{18-20}{8-10}$. Olive, with two darker or blackish longitudinal bands on each side, the upper from the occiput to the base of the soft dorsal, the lower from the eye, over the opercle, to the extremity of the caudal fin; sides of body below lower lateral band and between pectorals and ventrals of a beautiful rose-colour; spinous dorsal grey, black at the base, the black area gradually rising to cover nearly the whole of the soft dorsal; pectoral, outer side of ventral, and extremity of anal blackish; caudal grey, with an oblique white streak above in the males.

Total length 95 millim.

Several specimens.

Most nearly related to *P. subocellatus* Gthr., from the Gaboon, but easily distinguished by the proportions of the dorsal spines.

21. PELMATOCHROMIS TENIATUS, sp. n. (Plate IV. fig. 3.)

Teeth in 2 series in the upper jaw, in 3 in the lower, outer largest. Depth of body 3 times in total length, length of head $3\frac{1}{2}$ times. Snout broad, rounded, with convex upper profile, as long as the eye, which is contained $3\frac{1}{3}$ times in length of head and nearly equals interorbital width; maxillary extending slightly beyond vertical of anterior border of eye; 2 series of scales on the cheek; large scales on the opercle. Gill-rakers short, 11 on lower part of anterior arch. Dorsal XVIII 7; spines gradually increasing in length to the last, which measures half length of head; longest soft rays produced into a filament, as long as head. Pectoral $\frac{4}{5}$ length of head. Ventral produced into a filament, extending beyond origin of anal. Anal III 7; third spine as long as longest dorsal. Caudal rounded. Caudal peduncle a little deeper than long. Scales smooth, $28\frac{2}{9}$; lat. l. $\frac{21}{9}$. Brownish above, yellowish beneath; two blackish longitudinal bands on each side, the upper from the occiput to the base of the soft dorsal, the lower from the eye, over the opercle, to the root of the caudal; fins greyish, ventrals white with a black outer border; oblique dark streaks on the soft dorsal; small blackish spots on the caudal and two larger ones edged with white on its upper border.

Total length 75 millim.

A single specimen.

Also nearly allied to *P. subocellatus*. Readily distinguished from it, and from *P. ansorgii*, by the dorsal formula.

22. TILAPIA MARIE Blgr.

This species was described from a single specimen from Azumine Creek, Opobo River, in Miss Kingsley's collection. Three specimens are in Dr. Ansorge's collection, the largest measuring 135 millim. The caudal fin is rounded rather than truncate. D. XVI 12-13; A. III 10; Sq. 29 30 $\frac{3\frac{1}{2}}{10}$; lat. l. $\frac{20-21}{12-13}$.

23. TILAPIA LATA Gthr.

GOBILDE.

24. ELEOTRIS SENEGALENSIS Stdr.

EXPLANATION OF THE PLATES.

PLATE II.

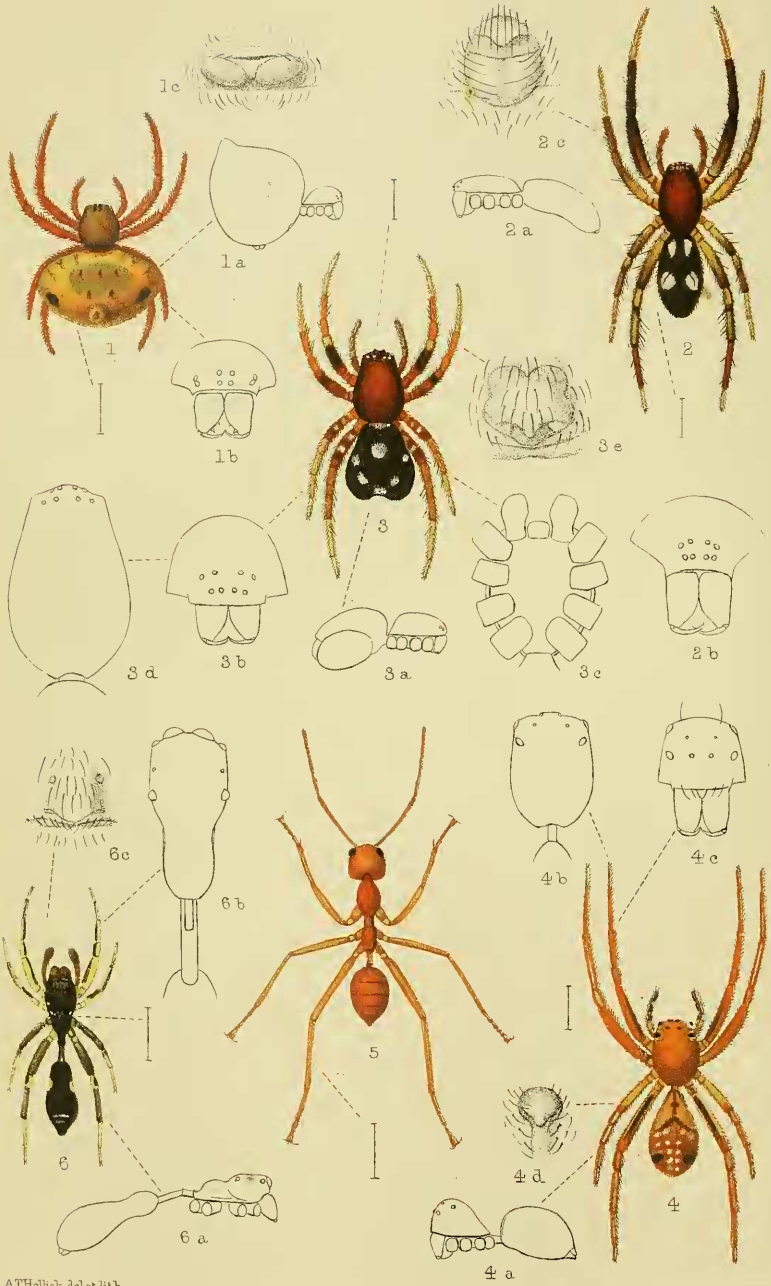
Phractolentus ansorgii, with upper, lower, and side views of head, and skeleton, p. 6.

PLATE III.

- Fig. 1. *Marcusenius longianalis*, p. 5.
2. *Polycentropsis abbreviata*, and skeleton, p. 8.

PLATE IV.

- Fig. 1. *Pelmatochromis ansorgii*, p. 8.
2. " *pulcher*, p. 9.
3. " *tenuatus*, p. 10.



ATHolick del. et lith.

West, Newman. chromo.

NEW EXOTIC SPIDERS.

2. On some new and interesting Exotic Spiders collected by Messrs. G. A. K. Marshall and R. Shelford. By the Rev. OCTAVIUS PICKARD-CAMBRIDGE, M.A., F.R.S., &c.

[Received December 6, 1900.]

(Plate V.¹)

Order ARANEIDEA.

Fam. DRASSIDE.

Gen. PROTHESIMA L. Koch.

PROTHESIMA ALBOMACULATA, sp. n. (Plate V. figs. 2-2 c.)

Adult female, length $2\frac{1}{3}$ lines (4.5 mm.).

Cephalothorax flattish, oval, truncate at each end, fore end rather the narrowest, lateral marginal impressions at caput very slight, profile-line nearly level. Colour deep black-brown, softening to yellowish brown round the thoracic indentation; surface thinly covered with grey adpressed hairs.

Eyes in two transverse rows of very nearly equal length. Curve of posterior row slight and its convexity directed backwards. Anterior row almost straight, laterals of this row largest of the eight, the two centrals being placed on a slight prominence, and further from each other than from the laterals. The two centrals of the posterior row are much further from each other than from the laterals and are slightly the largest. The four centrals form a quadrangle as long as broad, the fore side being shortest.

Legs moderate in length and strength, 4, 1, 2, 3. Colour yellow to yellow-brown; the tibiæ, femora, and genuæ of the first pair black-brown, these joints of the second pair yellow-brown, and of the third and fourth pairs more or less deeply marked longitudinally and suffused with black and brown, furnished with coarse hairs and spines, the latter most numerous and strongest on the tibiæ and metatarsi of the third and fourth pairs.

Falces, *maxillæ*, and *labium* deep brown.

Sternum oval, pointed behind; colour reddish yellow-brown.

Abdomen oval, somewhat flattened, black, with four conspicuous white spots forming a quadrangle on the fore half of the upperside, the two hinder spots largest and nearly round, the anterior, near the fore margin, oval or subtriangular and forming a shorter transverse line than the hinder spots. On each side of the underside, about the middle, is a large somewhat irregular triangular-shaped white patch, whose inner angles are nearly contiguous a little way behind the middle. Spinners of the inferior pair much wider apart than the superiors. Genital aperture simple but characteristic in form.

Hab. Salisbury, Mashonaland, S. Africa, 5000 feet, Nov. 1898 to Jan. 1899 (G. A. K. Marshall).

¹ For an explanation of the Plate, see p. 16.

Gen. nov. TITUS.

Cephalothorax elongate-oval, rounded behind, broadly and a little roundly truncate before; lateral marginal impressions at the caput gradual but distinct; upper surface strongly convex; from the fore part of the caput to the hinder slope the rise is strong, a little curved and even, with a very slight dip at the thoracic junction. The sides of the cephalothorax project over the bases of the legs, making them appear to be articulated on the same plane as the sternum. The thoracic indentation is very minute, and the other normal ones obsolete; hinder slope steep; height of the clypeus, which projects, is half that of the facial space, its fore margin overhanging the base of the falces.

Eyes moderate and not greatly unequal in size; in two transverse curved rows; the hinder row considerably longest, its eyes are very nearly equally separated, and the convexity of its curve is directed forwards, while that of the anterior row is backwards. The hind-lateral eyes are larger than the hind-centrals and are placed outside a strong tubercle; those of the anterior row on a well-marked transverse prominence or ridge. The fore-centrals are very nearly if not quite of equal size, the interval between them being about double that which separates each from the fore-lateral eye on its side. The central quadrangle is slightly broader than long, and its anterior side shortest.

Legs short, rather slender, 4, 1, 2, 3; the femora strongly clavate or tumid at their posterior end, furnished with hairs and spines; two pairs of these are beneath the metatarsi and three pairs beneath tibiae of the first pair. Tarsi end with 2 claws.

Palpi (♀). The digital joint is double the length of the radial, rather claviform, and ending with a very minute, slightly curved single claw.

Falces moderate in length, powerful, subconical.

Maxille rather short, strong, straight, but inclined to the labium; rounded at their outer extremity, and a little impressed and obliquely truncate at their inner extremity.

Labium short, broader than long, narrowest at the apex, the outer corners of which are rounded, and the middle a little impressed.

Sternum longer than broad, oval, slightly hollow-truncate in front, bluntish pointed behind, and its margins strongly indented by the basal joints of the legs. From the hinder end a chitinous plate runs between the coxæ of the fourth pair of legs and spreading out behind them joins in with the upperside of the cephalothorax.

Abdomen short, broad, its upper surface covered with a strong kind of granulose coriaceous shield furnished with plumose and other hairs; sides, especially backwards, protuberant and tumid, these parts connected behind by transverse rugæ or folds, in the midst of which the spinners are placed and almost hidden in a circular cavity.

TITUS LUGENS, sp. n. (Plate V. figs. 3-3*e*.)

Adult female, length $2\frac{1}{2}$ lines.

Cephalothorax bright red-brown, suffused with a darker hue on the sides and on the caput, the fore part of which is nearly black; the surface is thickly covered with small round shining tubercles or granulosities, and it is thinly clothed with hairs, of which some on the sides and hinder part are white and of a plumose nature.

Legs yellow tinged with brown; the femora much strongest, granulose, as also are the uppersides of coxæ. Colour of the femora of 1st pair black-brown, of the second pair not so dark, of the third and fourth pairs paler and indistinctly banded with darker. The tarsi are enlarged slightly and gradually to the ends, which are furnished with two claws and a compact claw-tuft.

Palces deep reddish black-brown, paler at the fore extremity, furnished in front with bristly hairs.

Maxillæ and *labium* yellow-brown.

Sternum yellow-red, covered thickly with small granulosities like the cephalothorax.

Abdomen coriaceous, covering of the upperside black with a central triangular patch of white plumose hairs, two patches of the same on the lateral margins, and one at the hinder extremity, sides and underside of a paler browner hue. The fore extremity on the underside is covered with a coriaceous granulose integument (the granulosities much strongest and becoming tubercular at the fore end), which forms a short sheath, covering most of the connecting pedicle as well as the spiracular openings and the genital aperture. For the peculiar form of the abdomen, see generic characters above; but whether this is only specific or whether generic, it is hard to say in the absence of allied species.

Hab. Salisbury, Mashonaland, S. Africa, 5000 feet, Nov. 1898 to Jan. 1899 (*G. A. K. Marshall*).

Fam. EPEIRIDÆ.

Genus NEPHILENGYS L. Koch.

NEPHILENGYS MALABARENSIS Walck.

An adult female of this common and widely dispersed Epeirid from Karkloof, Natal (*G. A. K. Marshall*).

Fam. GASTERACANTHIDÆ.

Subfam. EURYCOMINÆ.

(Gen. CYRTARACHNE Thor.

CYRTARACHNE CONICA, sp. n. (Plate V. figs. 1-1*c*.)

Adult female, length rather over $3\frac{1}{2}$ lines, or 8 mm.; length of abdomen $2\frac{1}{2}$ lines, width $3\frac{1}{3}$ lines.

Cephalothorax short, slightly longer than broad, broadest and

rounded behind, truncate before; the profile-line forms a continuous curve; the lateral marginal impressions at the caput are very slight. Colour yellowish brown.

Eyes small, in the ordinary Epeirid position; the four centrals form as nearly as possible a square, its posterior eyes slightly largest. The lateral pairs are close to the anterior corners of the caput, minute; those of each pair are contiguous to each other and form nearly a straight line with the anterior pair of the central quadrangle.

Legs short, not very strong, 1, 2, 4, 3, devoid of spines, furnished with fine hairs only; colour brownish yellow, tinged with orange.

Falces short, strong, subconical; colour like that of the cephalothorax. Maxillæ and labium normal in form, and similar in colour to the cephalothorax, perhaps rather paler.

Sternum similar in colour to the legs.

Abdomen coriaceous, large, subtriangular, broader than long, rounded in front, the fore corners rounded, though scarcely to be described as forming distinct prominences; upper surface considerably elevated in a subconical form; colour yellowish white, that of the cone tinged with yellow-brown. Near the middle of the anterior margin, quite visible but not very distinct, are three sigilliform markings with two others behind, halfway to the summit of the conical abdomen; behind these last, and one on either side of the base of the cone, are two others similar, in a transverse line, and forming a line equal in length to that formed by the three anterior sigillæ; the upper part of the cone is encircled by some indistinct fine darker concentric lines. The underside is dark dull yellow-brown, and from the outer margins of it sundry fine dark lines issue upwards in groups of two or three, converging until they meet about one-third of the way towards the top of the cone. Genital process broad and very characteristic in form.

Hab. Singapore (*R. Shelford*).

Fam. THOMISIDÆ.

Subfam. AMYCIINÆ.

Genus AMYCLÆA Sim. (*Amycle* Cambr.).

AMYCLÆA LINEATIPES, sp. n. (Plate V. figs. 4-4 d.)

Adult female, length $2\frac{1}{2}$ lines.

This Spider is nearly allied to *A. forticeps* Cambr. (*P. Z. S. Lond.* 1873, p. 122) from Ceylon, and bears a close general resemblance to it; but it may be distinguished by the shorter legs, by the area of the four larger outer eyes, of which the anterior is of the same length as the posterior side, and the four anterior eyes forming a straight transverse line. The markings on the legs, palpi, and abdomen, and the form also of the abdomen, differ from those of *A. forticeps*, though it is possible that this last character may only be sexual.

The *palpi* have a longitudinal black streak on their inner sides.

The *legs* have a longitudinal red-brown streak on the outer side of the femora of the first pair, and a blackish one on the inner side of those of the fourth pair, a white line also runs along the side of the tibiæ and metatarsi; the tarsi of the first and second pairs are white; the general colour of the legs is dull orange-yellow.

The *abdomen* is joined to the thorax by a distinct jointed pedicle; it is of an oval form, broadest behind and pointed in front, and without any lateral transverse constriction. It is of a dull yellowish hue tinged with reddish; on either side towards the hinder extremity is a large black spot; along the middle of the upper side on the hinder half are two converging rows of small white spots, with some other white ones towards the fore extremity; on each side also of the fore half are two broadish, but not very strongly defined, oblique brownish stripes, the hinder ones meeting at an angle in the middle and continued in the median line to the fore end. The genital aperture is well marked and of a very characteristic form.

Hab. Singapore. Sent to Mr. Shelford by Mr. H. N. Ridley, Director of the Botanic Gardens, Singapore.

The type of the genus, *A. forticeps* Cambr. (Ceylon), has two similar spots on the abdomen.

This Spider was found in company with the ant *Ecophylla smaragdina*, the habits of which have been described by Mr. Ridley (Journ. Asiat. Soc., Straits Branch, 1890, No. 42, p. 345).

Fam. SALTICIDÆ.

Genus SALTICUS Latr. (sensu restricto).

SALTICUS ATTENUATUS, sp. n. (Plate V. figs. 6-6 c.)

Female (immature), length (including palces) $3\frac{1}{2}$ lines = 7 mm.

Cephalothorax oblong, narrowing gradually to the posterior end, which is truncate. Caput flat, rather longer than the thorax and rather longer than broad, divided from the thorax by a deep indentation or constriction. Colour deep black-brown on the thorax; caput black; in the constriction are three short lines or patches of white hairs, one on each side and one in the middle.

Eyes normal, ocular area longer than broad.

Legs rather short, furnished with short hairs, and a few fine spines in pairs beneath the tibiæ of the first and second pairs: these are of a pale yellow colour; the outer side of the tibiæ, metatarsi, and tarsi of the first pair, and of the tibiæ and metatarsi of the second, marked with a longitudinal black stripe; the coxæ, femora, tibiæ, and base of the metatarsi of the third pair black, the rest pale yellow; the fourth pair have the coxæ pale yellow, with an exterior longitudinal black line on the outer side, and the femora and tibiæ black, the metatarsi and tarsi being yellow.

Palpi yellowish; radial joint blackish; digital joint large, oval, flattish and tumid.

Falces rather shorter than the caput, strong, prominent, of a dull yellow-brown colour.

Maxille dull blackish, extremities pale yellowish.

Labium dull black, apex pale.

Sternum elongate, narrow; the basal joints of the legs are articulated around it on the same plane, the first two pairs with their coxæ almost contiguous on their inner sides.

Abdomen narrow, elongate-oval, strongly and broadly constricted towards the fore extremity; pedicle as long as the caput, two-jointed, the posterior joint longest and set in a circular cavity or socket at the extremity of the abdomen. Colour black, a little paler at the constricted part, just below the sides of the constriction white.

Hab. Singapore. Sent by Mr. H. N. Ridley to Mr. R. Shelford.

EXPLANATION OF PLATE V.

- Fig. 1. *Cyrtarachne conica*, ♀ (p. 13). 1 *a*, profile; 1 *b*, eyes and falces from in front; 1 *c*, genital aperture.
2. *Prothesima albonaculata*, ♀ (p. 11). 2 *a*, profile; 2 *b*, eyes and falces from in front; 2 *c*, genital aperture.
3. *Titus lugens*, ♀ (p. 13). 3 *a*, profile; 3 *b*, eyes and falces from in front; 3 *c*, maxillæ, labium, and sternum; 3 *d*, cephalothorax and eyes from above and behind; 3 *e*, genital aperture.
4. *Amyscia lincatipes*, ♀ (p. 14). 4 *a*, profile; 4 *b*, eyes and falces from in front; 4 *c*, eyes and cephalothorax from above and behind; 4 *d*, genital aperture.
5. *Æcophylla smaragdina* (p. 15). (Ant with which *Amyscia lincatipes* lives.)
6. *Salticus attenuatus*, ♀ (p. 15). 6 *a*, profile; 6 *b*, cephalothorax and connecting pedicle from above; 6 *c*, genital aperture. (It is doubtful whether this example is quite adult.)

3. Notes on the Anatomy of Picarian Birds.—No. IV. On the Skeletons of *Bucorvus cafer* and *B. abyssinicus*; with Notes on other Hornbills. By FRANK E. BEDDARD, M.A., F.R.S., Prosector and Vice-Secretary of the Society.

[Received January 14, 1901.]

(Text-figures 2-5.)

The opportunity of comparing the two known species of Ground-Hornbills, *Bucorvus cafer* and *B. abyssinicus*, has been afforded me by the death of an example of each of them during the past year in the Society's Gardens. I have taken the opportunity of comparing the structure of the genus *Bucorvus* with several forms of arboreal Hornbills, of which I possess skeletons, with a view of separating from a general description of *Bucorvus* those features in which it is different from other Hornbills, and which are therefore distinctive characters of the genus, or subfamily as some would prefer to regard it.

I limit myself in the present communication to the skeleton,

since I have nothing new to add to my¹ earlier account of the muscles and the viscera of *Bucorvus* and other genera of Hornbills, or to Prof. Fürbringer's² almost contemporaneous investigations upon the same subject. The latter work contains, naturally, a number of facts relating to the skeleton of the Hornbills in general, as well as of *Bucorvus*; but these, as might be expected, deal chiefly with the shoulder-girdle. Another source of information concerning the bones of the Bucerotidæ is Mr. Eytton's 'Osteologia Avium,' which work includes figures of the skeletons of *Bucorvus* and of a few other forms together with some quite brief notes in the text. The family is of course not neglected in the general works of Dr. Gadow³ and myself⁴ upon bird-anatomy.

There is, however, at least so far as I am aware, no account of the bones of the two species with which I deal here—no comparison of the two forms.

Vertebral Column.—Only two features in the vertebral column distinguish the two species of *Bucorvus*. In the first place, the relative lengths of the several regions differ: in *Bucorvus cafer* the cervical series (13 vertebræ in both birds) is shorter than that of *B. abyssinicus*. The total difference of length is rather more than an inch, and each individual vertebra is distinctly shorter than the corresponding one of the other species. This is not an expression of a smaller-sized bird, since the dorsal vertebræ are of exactly the same length collectively and individually in the two species. Nor is there any difference except the very minutest in the lengths of the sacral and caudal series. The last cervical vertebra of *B. cafer* has a transverse process which is slightly more rib-like than is that of *B. abyssinicus*. Though firmly welded to its vertebra, the homologue of the rib is more slender, as is the case in those birds where it is a free structure.

The second point of difference concerns the presence of an additional rib in *B. cafer* at the end of the series. The vertebra bearing that rib is not, however, free itself. The rib is long and slender.

Vertebral Column of Bucorvus compared with other Hornbills.—The great breadth and excavation below of the cervical vertebræ distinguish *Bucorvus* from *Buceros*. There are, moreover, thirteen of them, while in *Buceros* the thirteenth vertebra bears a small but movable rib on each side. In *Bucorvus* there are no closely approximated catapophyses; in *Buceros* the 11th vertebra has a pair of these. The remaining salient characteristic of *Bucorvus* is the slenderness of the pygostyle, which might be expected in a ground-living bird.

Sternum.—The only difference that I could detect between the sterna of the two species was that in *B. abyssinicus* the lateral incision of the xiphisternum is not nearly so deep as in *B. cafer*.

¹ "On some Points in the Structure of the Hornbills," P. Z. S. 1889, p. 587.

² "Untersuchung zur Morph. d. Vögel," Amsterdam, 1888.

³ Bronn's 'Ordnungen des Tierreichs,' Aves.

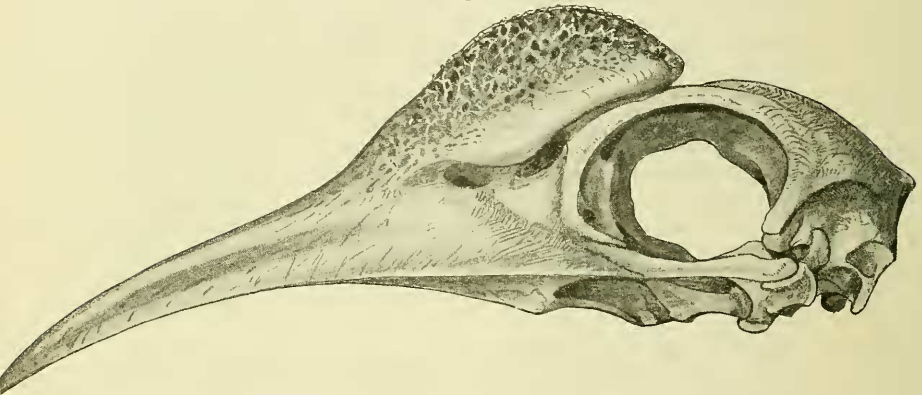
⁴ 'The Structure and Classification of Birds,' Longmans, 1896.

There is no need to enter into comparisons between this and other parts of the shoulder-girdle in the Ground-Hornbills and the arboreal forms, since the structure and relations are as nearly as possible identical. This seems to show that use is a more important factor than disuse in the modification of organs, since the hind limbs show noteworthy differences.

Skull.—Very slight, but still perfectly recognizable and definable, differences distinguish the skulls of the two species of *Bucorvus* (cf. text-figs. 2, 3).

The most striking difference is, however, possibly a sexual one: in *B. cafer* the bony prominence on which sits the casque of the bird is much lower than it is in *B. abyssinicus*, and at the same time its texture is decidedly more solid; in *B. abyssinicus* this part of the skull is formed of very delicate cancellated bony tissue which immediately underlies the horny casque. My specimen of *B. cafer*,

Text-fig. 2.



Skull of *Bucorvus abyssinicus*, ♂. ($\times \frac{1}{2}$.)

however, is a female bird; the skeleton of *B. abyssinicus* belongs to a male.

When the two skulls are viewed from above, they can be readily distinguished by the greater breadth of that of *B. cafer*. The widest part is just behind the orbits. The measurements in the two species are as follows:

Bucorvus cafer Length 206 mm.; breadth 63 mm.

B. abyssinicus Length 203 mm.; breadth 59 mm.

A very small fragment of the tip of the beak in *B. abyssinicus* was, however, broken off and lost. This would therefore increase the length of the skull in that species, and thus render the proportions a little more striking than is apparent from the measurements. The greater breadth of the skull in *B. cafer* can, however, be well appreciated without any measurements at all.

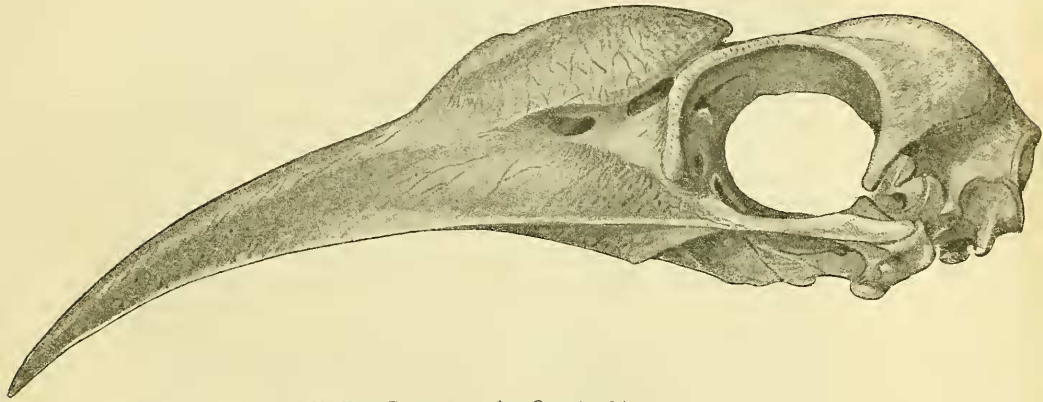
A third feature in which the skulls of the two Ground-Hornbills

differs is in the form of the occipital condyle. In *B. cafer* it is a little more elongated transversely than in *B. abyssinicus*. As will be seen from an inspection of the accompanying drawings (text-figs. 2, 3), the outline of the orbit is a little different in the two species.

In other respects the two skulls can hardly be distinguished.

Characteristics of the Skull of Bucorvus.—These can be arrived at from a comparison of the two species of *Bucorvus* with a skull of *Buceros rhinoceros*, which I shall take as a type of the arboreal Hornbills, indicating at the same time such divergences as are exhibited by other arboreal Hornbills. In comparing the skulls of the two, the first striking difference between the two genera is that shown by the cancellated bone which fills the casque. This, in *Buceros*, is solid behind where it projects back considerably over the roof of the skull; anteriorly it ends abruptly in a steep declivity

Text-fig. 3.



Skull of *Bucorvus cafer*, ♀. ($\times \frac{1}{2}$.)

which is formed of finely and beautifully cancellated bone. In *Bucorvus*, on the contrary, whether the cancellated bone shows exteriorly or not, the whole bony process slopes gradually, first upwards and then downwards in an even curve, there being no abrupt demarcation between it and the maxillæ in front. In *Buceros* a delicate shelf of bone slightly projecting marks the anterior boundary of the bony part of the casque. When the skulls of the two Hornbills are viewed laterally, notable differences are obvious. The walls of the brain-case are seen to arise in *Buceros* to a considerable distance above the orbit. The top of the skull is in fact swollen and convex. In *Bucorvus*, on the other hand, the top of the skull is almost flat and it is continued to form a projecting shelf over the orbit, which thus stands out more conspicuously from the sides of the head than in *Buceros*. The prominence of the orbit in *Bucorvus* is further emphasized by the prolongation downwards in front of the lacrymal region of a plate

of bone to form a projecting ridge which joins the jugal arch behind. This renders the margins of the orbit perfectly visible when the skull is viewed directly from the front. In *Buceros* there is no such ridge, and the orbit is invisible when the skull is looked at from in front.

The narial aperture is double on each side in *Bucorvus* as it is in, for example, the Toucans. Each of the two apertures into which the originally single aperture is divided in this genus is of a rather elongated oval outline. In *Buceros* the single narial orifice is circular in outline.

A comparison of the dorsal aspect of the skull in the two genera shows several points of divergence in the two types. The greater breadth of the cranium of *Bucorvus* is apparent, this being mainly due to the projecting shelf of bone over the orbit, already referred to. Furthermore the "lacrymal" ring in front of the orbit which is absent or at least not so fully developed in *Buceros*, causes a very sharp demarcation between the cranium and the face in *Bucorvus*, a distinction which is wanting in *Buceros*, where one region gradually fades into the other. The commencement of the beak region is quite as wide as the anterior part of the orbit in *Buceros*; in *Bucorvus* it is very plainly much narrower. The contrast is so great that measurements are unnecessary to express the differences.

The basal aspect of the skull of *Bucorvus* is in some respects different from that of *Buceros*. In the first place, the foramen magnum in *Bucorvus* is much more distinctly upon the ventral surface than in *Buceros*, where this foramen looks partly backwards. It thus happens that the dorsal wall of the foramen is more apparent on a dorsal view in *Buceros* than it is in *Bucorvus*. The palatal region too shows differences which are not without a certain interest in relation to the connection between the two types of Hornbill. As has been already recorded by Fürbringer, the Bucerotidæ possess basiptyergoid processes. These are, however, rudimentary, and are far from being in contact with the pterygoids. In *Buceros* not only are there present a pair of somewhat jagged rudimentary basiptyergoid processes, but the pterygoids themselves are bowed inwards opposite to these processes; at the place where they should, so to speak, articulate with the basiptyergoid processes they bear a roughened outgrowth which seems to suggest the remains of a pterygoid articular facet.

So exactly does the position of this facet correspond to the basiptyergoid process, that if the bones could be forcibly pushed together they would meet at those points. *Bucorvus* shows a further stage of degeneration, which fits in well with the presumption that it is a later type than *Buceros*. The basiptyergoid processes are distinctly more rudimentary, and, indeed, they are only just recognizable in *B. abyssinicus*. The pterygoids are straight, and are not at all bowed inwards towards the basiptyergoid processes. In the place of what I have regarded as an articular facet upon the pterygoids in *Buceros*, there is in *Bucorvus* a thin, large, upwardly directed lamellar process of bone. This, however,

is only to be seen in *B. cafer*. I consider this plate of bone arising from the pterygoid to be the homologue of the rudimentary articular facet of *Buceros*, but increased in a different direction. As is sometimes seen with degenerating organs, it has as it were run to seed. That it does not point toward the basiptyergoid may perhaps be put down to the straightening and consequent rotation of the pterygoid.

The majority of these differences also hold good for other genera of arboreal Hornbills. The distinction between the cancellated bone which fills the casque, the maxilla, and between the posterior and anterior regions of the core of the casque is apparent even in the almost casque-less *Aceros*. The really casque-less *Tocus* may be left out of consideration. The principal feature in which the skulls of other Hornbills are less marked than *Buceros* are the lower elevation of the brain-case and the comparative straightness of the pterygoids.

Pelvis of Bucorvus and Buceros.—The pelves of the two species of *Bucorvus* agree exactly in the proportions of the pre- and of the post-acetabular regions. But when the genus is compared with *Buceros*, differences appear. In the latter genus the two regions of the pelvis which are separated by the antitrochanter are as nearly as possible equal in length; in *Bucorvus* the posterior region of the pelvis is rather the longer. This difference is coupled with another, viz., the greater depth of the ischia of *Buceros*, and the consequently more acute angle formed by the pubes with the longitudinal axis. In *Bucorvus* the pubes slope more nearly parallel to the long axis of the pelvis. One cannot but put down this difference to the difference in mode of life exhibited by the two genera.

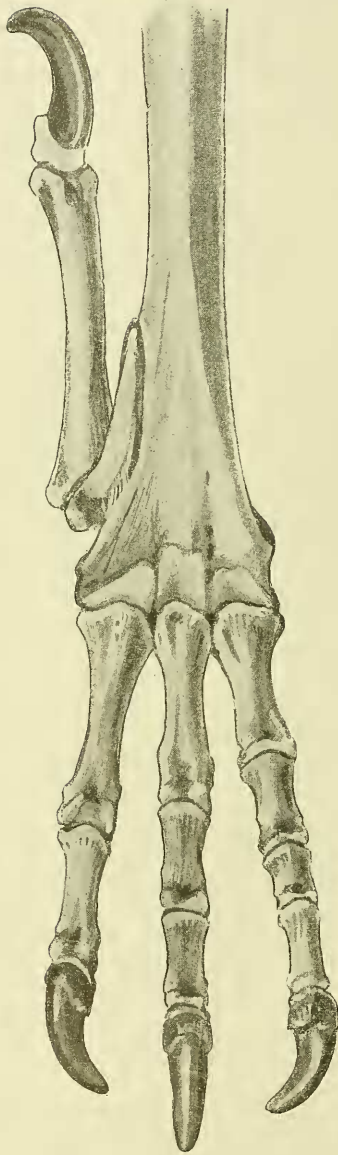
Hind Limb.—Measurements of the proportions of the several sections of the hind limb in the two species show some slight differences which are perhaps worthy of being recorded. In *Bucorvus abyssinicus* the measurements were as follows: femur 110 mm.; tibia 200 mm.; metatarsus 157 mm.; middle toe 90 mm. Of *B. cafer* the corresponding figures were 100; 185; 135; 77.

Hind limb of Bucorvus and Buceros.—It is of course well enough known that the Ground-Hornbills have longer legs than the arboreal genera; but nevertheless a few exact measurements may be useful. I append therefore a number of such measurements (in millim.), which have been taken in every case from the dried skeleton:—

	Femur.	Tibia.	Metatarsus.	Middle toe.
<i>Buceros rhinoceros</i>	90	125	62	77
<i>Rhytidiceros plicatus</i>	74	102	49	62
<i>Dichoceros bicornis</i>	108	141	71	80

It is plain from these measurements that the tibia is shorter relatively to the femur in the flying Hornbills, and that the metatarsus in the same birds is shorter relatively to the tibia than in the Ground-Hornbills. Taking the femur in all cases as 1, the

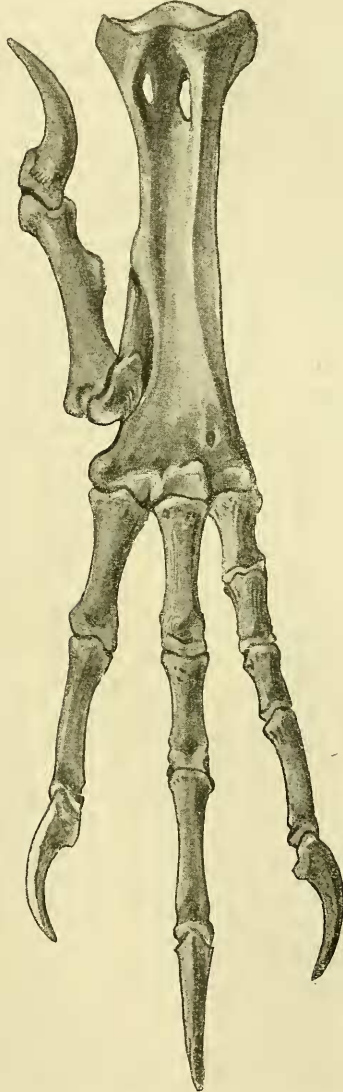
Text-fig. 4.

Left foot of *Bucorvus abyssinicus*. (Nat. size.)

proportions of the segments of the hind limb in *Bucorvus* and *Buceros* will be (quite roughly) these :—

<i>Bucorvus</i>	1	2	$1\frac{1}{2}$	1
<i>Buceros</i>	1	$1\frac{1}{2}$	$\frac{1}{3}$	1

Text-fig. 5.

Left foot of *Buceros rhinoceros*. (Nat. size.)

A final point of some little interest concerns the bones of the foot. Perching and walking on the ground are clearly two very different modes of using the feet, and we should therefore expect to find some corresponding differences in the structure of the foot. As a matter of fact, such differences do occur in the two series of Hornbills. In *Buceros* the middle metacarpal is if anything slightly longer than that of the second toe, while the fourth metacarpal is about one half of the length of the two metatarsals of the middle toes. In *Bucorvus* the second metatarsal is slightly longer, and also rather stouter, than the third metatarsal, while the fourth metatarsal is not so much reduced as in *Buceros*. It is clear then, that, apart from the differences in length which distinguish the genera, the prevailing toe in the bipedal *Bucorvus* is the second, which is really functionally the first toe, for the true first toe is of course turned backwards. It is true that the third toe is the longest; but nevertheless the increased length of the second metatarsal gives to that toe a preponderance in the foot. This state of affairs contrasts with that observable in the quadrupedal Ungulates, where it is the middle toe (or the two middle toes) that is the prevailing one. In correspondence with the greater length of the second metatarsal, the tibio-tarsus is more strongly developed on that side and projects beyond the rest of the bone, the articular surface of which is therefore oblique to the transverse axis of the leg. In *Buceros* the line of articulation is exactly transverse. This will be apparent from the drawings exhibited (text-figs. 4 & 5, pp. 22 & 23). The last-mentioned feature is not, however, distinctive of *Bucorvus*; for in *Rhytidiceros* the same obliquity at the end of the tibio-tarsus occurs. In *Toccus*, moreover, in addition to the obliquity, the second metatarsal is the longest.

From this description of certain features in the anatomy of *Bucorvus*, the osteological characters of the genus and of the two subspecies *B. cafer* and *B. abyssinicus* can be formulated:—

Genus BUCORVUS.—Cervical vertebræ 13, short and broad, with concave centra and transverse processes forming a gutter beneath. No catapophysial canal or approach towards one. Pygostyle comparatively rudimentary.

Skull flat above, with marked shelf-like supraorbital plates. Foramen magnum ventral in position. Pterygoids straight. Basipterygoid processes rudimentary. Bony core of casque not sharply marked off from maxilla in front.

Second metatarsal the stoutest and longest; end of tibio-tarsus oblique. Tibia twice as long as femur; tibio-tarsus one and a half times as long.

B. cafer.—Neck comparatively short. Sternum rather deeply notched with one incision. Skull broad in proportion to length.

B. abyssinicus.—Neck comparatively long. Sternum not deeply notched. Skull narrower in proportion to length.